Fourth rock from the Sun takes center stage beginning in December 2003

By Bill Jeffs

British-developed Beagle 2 designed to sniff out life on Mars

Editor's note: As of press time, the Beagle 2 lander and Mars Exploration Rovers were all on their way to the Red Planet.

This illustration shows the Beagle 2 lander exploring Mars for signs of life.

Hitchhiking on the Mars Express spacecraft developed by the European Space Agency (ESA), the British-developed Beagle 2 was launched June 2 on a Soyuz-Fregat rocket from the Baikonur Cosmodrome in Kazakhstan to begin its 250-million-mile, six-month journey to Mars.

"Beagle 2 is the first-of-a-kind spacecraft uniquely equipped to search for signs of past and present life on Mars," said Everett Gibson, NASA Planetary Geochemist at Johnson Space Center. Gibson is the only American interdisciplinary scientist chosen by ESA to be a member of the Beagle 2 international science team.

"The goal of Beagle 2 is to enable us to establish evidence of whether life existed in the past on Mars," Gibson said, "or at least enable us to establish if the conditions there were ever suitable for the formation of life, and, significantly, to search for present signs of life."

Beagle 2 was scheduled to separate from the Mars Express spacecraft on Dec. 19 to begin its descent at a rate of 14,000 mph.

The spacecraft's planned landing site was Isidis Planitia, the third-largest basin on Mars. Possibly filled with sediments deposited at the bottom of long-vanished lakes or seas, the site offers an ideal environment for preserving traces of life. The site was chosen for this reason, and to enable Beagle 2 to communicate with orbiting spacecraft – Mars Express and NASA's Odyssey and Global Surveyor, already in orbit about Mars. These spacecraft are to relay information back to control centers in Darmstadt, Germany, and Leicester, England.

With a mass of only 73 pounds, ESA's Beagle 2 lander represents the most ambitious science payload-to-systems mass ratio ever attempted. About one-third of the payload was designed to carry out various types of scientific analysis or be used to manipulate and collect samples for study on the surface of Mars.

"In 1976, the two Mars Viking landers searched for signatures of life, but the analytical results were either negative or indeterminate," Gibson said. "Our abilities to detect the presence of trace levels of the biogenic elements…are better now. Beagle 2 is carrying a much more powerful suite of instruments to detect the signatures of past or present life."

Beagle 2 has been in development for more than six years. In 1997, when ESA announced the Mars Express mission, the possibility of a lander dedicated to looking for life and conducting geochemical and atmospheric analyses was put forward by Colin Pillinger, a professor at The Open University in England and a member of the ESA Exobiology Study Group. The lander was soon named Beagle 2 to celebrate Charles Darwin's 1831 voyage on *HMS Beagle,* when he sailed as the ship's naturalist and which led to the writing of "On the Origin of Species."

Design of the spacecraft – led by a British consortium of universities, research support teams and industry – progressed quickly. Testing on the spacecraft's airbag landing system was conducted in the vacuum chamber at JSC in late 2002 and early 2003 (see sidebar).

The spacecraft is one of a number of ongoing robotic missions to Mars, including NASA's Mars Exploration Rovers (see sidebar).

"This is an exciting time for space science and robotic missions," Gibson said.

Beagle 2 landing test: Let me down easy

Beagle 2 was designed to land somewhat softly, surrounded by a system of airbags that are planned to inflate between 1,200 and 1,500 feet above the surface of Mars. To test this system, ESA needed to drop and accelerate the assembly from a high distance and to do so in a vacuum environment.

JSC's unique vacuum chamber, Chamber A in Building 32, fit the bill. Arrangements were made to test the assembly there in 2002. In the course of the testing, adjustments were made to the assembly's inflation pressure and jettison pyrotechnics until everything functioned as designed.

Final testing was done in early 2003, and Beagle 2 was successfully launched on June 2.

The enormous Chamber A in JSC's Building 32 provided the perfect location for the Beagle 2's landing tests.

jsc2002e24701
Photo by Robert Markowitz

Two NASA engineers explore the Red Planet

Many people dream of exploring Mars, but for Johnson Space Center Space Scientists Doug Ming and Dick Morris, those dreams are becoming reality.

Ming, a soil mineralogist, and Morris, a physical chemist, are members of a small team that will operate two Mars Exploration Rovers (MERs) from Earth. The vehicles were launched last summer to two regions of Mars to study minerals and search for evidence of liquid water that may have once existed on the Red Planet. The rover named Spirit launched June 10, while the second rover, Opportunity, launched July 7.

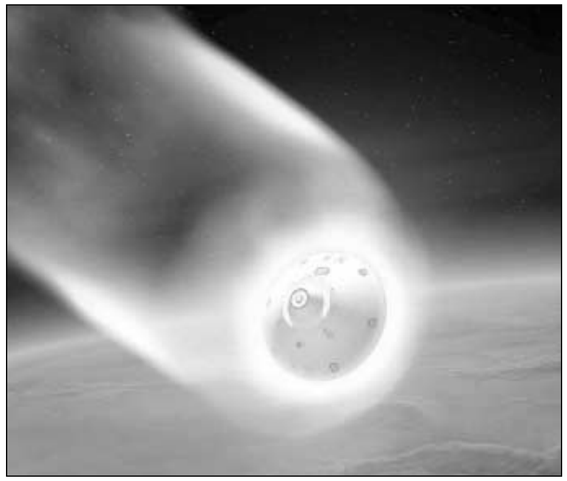
"JSC's long history of working with minerals and the Center's large collections have allowed us to become familiar with lunar rocks, meteorites and cosmic dust," Ming said. "That expertise will be helpful in interpreting and analyzing Mars samples."

Ming and Morris, along with other researchers, chose to study the selected regions of Mars because of land formations that seemed to be shaped by water and the presence of a certain mineral – hematite – that usually forms under wet conditions.

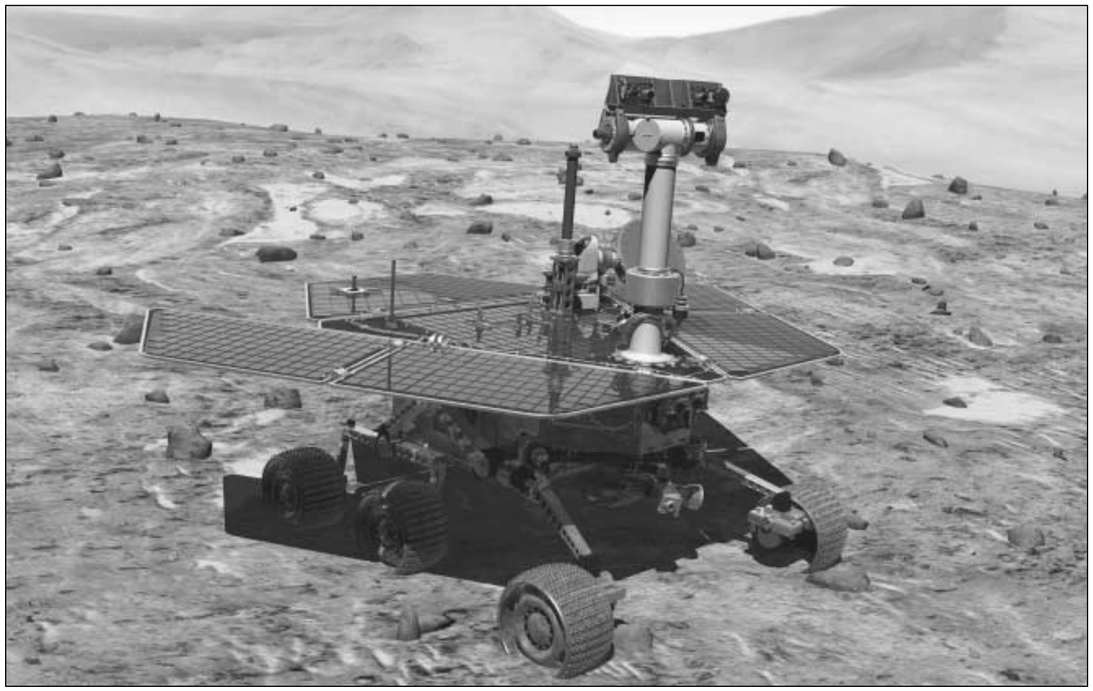
The MERs have better capabilities than some previous Mars rovers. For example, unlike the Sojourner rover that traveled about 100 yards in 12 weeks, the MERs are expected to travel up to 10 times that distance in their three-month mission.

"Operating this rover is like playing a video game," Morris said. "We will be looking at images that the rover sends back, and when we see something that might have scientific significance, we can go examine it."

Spirit and Opportunity are scheduled to land on the Red Planet on Jan. 3 and Jan. 24, respectively, and then begin their exploration.



(Above) The aeroshell protects the Mars rover from fiery temperatures as it enters the Martian atmosphere.



An illustration of one of the Mars Exploration Rovers on the Red Planet.

FOR MORE INFO

To learn more about the Mars Exploration Rovers, go to http://marsrovers.jpl.nasa.gov/home/index.html.

To learn more about Beagle 2, go to www.beagle2.com.